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ABSTRACT

This booklet summarizes three forums on current issues related to the use of technology for youth with disabilities. Forum 1, "Accessing the General Curriculum: Promoting a Universal Design for Learning" (November 3, 2001), featured David Rose and Chuck Hitchcock examining how universal design, recent neuro-scientific research, and technology have combined to create universally designed curriculum products useable by all students. Forum 2, "Creating Accessible Technologies--Practical Ways To Enable Youth To Reach Their Potential and To Overcome Barriers Faced in Employment, Education and Daily Living" (December 8, 2000), featured Gregg C. Vanderheiden in a presentation on creating accessible technologies with such key points as: how universal design benefits multiple populations; how changing technology is creating both new challenges and opportunities; and advantages and disadvantages of technology for persons with disabilities. Forum 3, "Preparing Youth with Disabilities for an Increasingly Technical Work Place" (January 26, 2001), featured a panel discussion on ways to prepare youth with disabilities for an increasingly technical work place. It addressed: (1) the Bridges Program to provide employment services and training to youth; (2) a study showing that successful high school work experience by youth with disabilities leads to higher adult employment rates; (3) a review of recent work force trends; and (4) the use of technology and accommodations in the work place. A list of resources includes forum presenters, Web sites, and examples of national policy on technology and individuals with disabilities. (DB)

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Summary of a Forum Series On —

Leveling the Playing Field — Technology as an Equalizer In Education, Transition to Careers and Daily Life

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Front Cover Photographs by Susan V. Steinkamp

Herman Fortson supervises student intern Tom Vineer at Glen Industrial Communications in Rockville, MD. Tom's skills were matched with the job requirements by an employer representative from the "Bridges...from school to work" transition program, who supports all aspects of his internship. Funded by the Marriott Foundation for People with Disabilities, the Bridges Program places students with disabilities in supported interships in their last year of school.

An interpreter helps student intern Vikki Washington communicate on the job at the Hewlett-Packard Company in Rockville, MD. Responsible for editing technical manuals, Vickki was matched with job requirements by an employer representative from the "Bridges...from school to work" transition program.

Student intern Kristen Doherty enters data for Employment Services at Marriott Corporation. Employer representative Jan Magill, from the "Bridges...from school to work" program, assists Kristen and her co-workers with workplace issues.

A sincere thank you goes to Marriott Foundation Bridges Program for graciously providing photographs of youth used in this publication. For further information on the Bridges Program contact: The Marriott Foundation for People with Disabilities, 301-380-7771, 301-380-6680 TDD.

Additional copies of this guide may be ordered by sending a check for $3.00, to cover postage and handling, to **American Youth Policy Forum, 1836 Jefferson Place, NW, Washington, DC 20036.** For discounted prices on quantitiy purchases, call us at 202-775-9731, or fax your request to 202-775-9733.

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American Youth Policy Forum

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About the Publisher

The American Youth Policy Forum (AYPF) is a nonprofit professional develoment organization based in Washington, DC. AYPF provides nonpartisan learning opportunities for individuals working on youth policy issues at the local, state, and national levels. Participants in our learning activities include: Congressional staff and Executive Branch aides; officers of professional and national associations; Washington-based state office staff; researchers and evaluators; and education and public affairs media.

Our goal is to enable policymakers and their aides to be more effective in their professional duties and of greater service—to Congress, the Administration, state legislatures, governors and national organizations—in the development, enactment, and implementation of sound policies affecting our nation's young people. We believe that knowing more about youth issues, both intellectually and experientially, will help them formulate better policies and do their jobs more effectively. AYPF does not lobby or take positions on pending legislation. We work to develop better communication, greater understanding and enhanced trust among these professionals, and to create a climate that will result in constructive action. Each year AYPF conducts 35 to 45 learning events (forums, discussion groups, and study tours) and develops policy reports disseminated nationally. For more information about these activities and other publications, visit our website at www.aypf.org. This report is also available on our website.

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The American Youth Policy Forum would like to thank **NEC Foundation of America** for its generous support for the forum series on "Technology as an Equalizer In Education, Transition to Careers and Daily Life" and this summary publication. The Foundation sees technology as an equalizer because it "enables people to improve their abilities and to assert and fully develop their potential."

A sincere thank you goes to the review board and American Youth Policy Forum staff who added their suggestions, contributing meaningful feedback and insight to this project. Donna Walker James wrote an original brief for the forum with Gregg Vanderhiden that was integrated into this publication.

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Preface

Technology aids students with disabilities by opening doors that had been closed previously. Although several federal resources, including the Individuals with Disabilities Education Act (IDEA), Medicaid, the Assistive Technology Act of 1998, and the Americans with Disabilities Act (ADA), provide general support to youth with disabilities, much work is needed nationwide to enhance the lives of students with disabilities by using technology more effectively to help students in their school careers, and in their transition from schooling to employment.

There are several national efforts to improve access to technology. At the beginning of his administration, President George W. Bush made the focus on increasing access to assistive and universally designed technologies a major part of his New Freedom Initiative. The President's proposal included increased federal funding for low-interest loans to purchase assistive technology, an Assistive Technology Development Fund to help small business bring assistive technology to market, and technology for Rehabilitative Engineering Research Centers and the Interagency Committee on Disability Research. The Federal Communications Commission (FCC) adopted rules in 1999 to enforce policy that requires telecommunications services and equipment to be accessible and useable to persons with disabilities, when readily achievable. Industry has been working with the FCC and people with disabilities to implement these rules. In December, 2000, the Access Board, an independent federal agency devoted to accessibility for people with disabilities, released the final rules for Section 508 of the Rehabilitation Act, which requires federal agencies, except in cases of undue hardship, to ensure that technology they maintain, procure or use is accessible to employees and members of the public who use it.

Increasingly, creative and innovative partnerships between employers and the education and training sectors are being formed that use technology to help youth with disabilities make effective transitions to the workforce. However, many policymakers who focus on "mainstream" education and career transition issues and programs have little knowledge of programs specifically designed for or adapted to individuals with disabilities. In all our programming and publications, AYPF is committed to the goal of building crosswalks among different policy issue areas and of pulling together researchers, evaluators, policymakers, and practitioners from diverse areas to learn from each

other. Thus, we hope that this publication will spark greater collaboration among policymakers who focus on "mainstream" education and career transition issues as well as those with an interest in youth with disabilities.

With the kind support of NEC Foundation of America, AYPF implemented three lunchtime forums on current issues related to the use of technology for youth with disabilities to assist them in getting the maximum benefit from their educational experiences, transition to the workforce, and daily lives. The forums were held on Capitol Hill in Washington, DC, at the end of 2000 and the beginning of 2001. They attracted a wide range of participants including representatives of the administration and Congress, state, and local policymakers, national associations, and media representatives. The forum events were promoted to individuals across a wide spectrum of education and youth development programs. Individuals working in the fields of educational technology, reform, leadership, assistive technology, special education, vocational rehabilitation, supported employment, and those interested in school-to-work transition attended.

This publication serves as a summary of what we learned in the three forums in this series and offers suggestions for lessons learned. It is our hope that it will educate and promote greater awareness of some of the good work being done to enhance the lives of youth with disabilities. I believe the most important lesson of the series is that through exploring technology as a means of leveling the playing field for youth with disabilities, we have the potential to use it to help *all* youth.

Sarah S. Pearson
American Youth Policy Forum
June 2001

Jonathan Hughes and his mother Carol Hughes are joined by President George W. Bush at an Atlanta airport in early spring 2001. Jonathan is 24 years old, and uses a power chair and augmentative communication device to accommodate his cerebral palsy. Carol is the Public Relations Officer for the Center for Rehabilitation Technology at the Georgia Institute of Technology. Permission to use this photo was given by Carol Hughes.

Introduction

Adaptive computers and assistive technologies offer significant opportunities for youth with disabilities to access academic, social, recreational, and communicative experiences that in the past were barriers or impossible achievements. Youth who are blind or who have low vision and youth with reading difficulties use screen readers so they can listen as computer software "reads" electronic books and Internet pages. Youth who have cognitive disabilities can use Personal Digital Assistants (PDAs) to help bridge their transition to the workplace by reminding them about both school and work assignments and keeping them on time for classes, meetings, and other duties. Youth with mobility disabilities can use a computer track and ball mouse for easier keyboard productivity; a voice recognition system to have the computer write what is spoken; an easy-grip device to make writing checks or other legal documents more stable for weak wrists or fingers; and hand controls, lifts, or ramps for vehicles for driving independently. Such devices can assist youth with disabilities in their schooling, as they transition to careers, and in their daily life.

Awareness of what such technology can offer youth with disabilities is influencing federal policies, congressional studies, and private sector activities.

The congressional Web-Based Education Commission's December 2000 study* highlighted the value of technology for youth with disabilities. This study unveiled one of the most comprehensive analyses ever undertaken of education and the Internet. Regarding students with disabilities, the Commission reported "learning over the Web can minimize the impact of disabilities by eliminating transportation barriers. It can allow students to reveal their disabilities at their discretion. It can promote quality among learners, with and without disabilities, reducing potential discrimination. And it can make previously inaccessible classroom materials accessible."

The federal government is strongly committed to providing accessible work environments for youth transitioning to employment. The U.S. Access Board issued rules for federal accessibility standards for elec-

*The study can be downloaded from www.webcommission.org.

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tronic and information technologies for use by federal employees and the general public federal agencies serve. This final rule, known as Section 508 of the Rehabilitation Act, applies to all federal agencies when they develop, procure, maintain, or use electronic and information technology (IT). As one of the largest purchasers of electronic and IT technologies, the federal government believes that these access standards will promote the design and production of accessible products in the IT industry that will be used by private sector employers and thus make it easier for youth with disabilities entering the work place.

This AYPF publication shows that the movement towards universal design of products—computer hardware and software, high-tech aids, work stations, and Internet sites—has wider benefits to all. Moreover, since education is well known to be one of the most significant equalizers for employment and career advancement, education integrated with accessible technology for youth with disabilities is essential. As the National Council on Disability phrases it in its report, *Federal Policy Barriers to Assistive Technology* (May 2000), technology makes things easier for people without disabilities while for people with disabilities, technology makes things possible—leveling the playing field.

Carol Boyer
RESNA (Rehabilitation Engineering and
Assistive Technology Society of North America)

Summary of Forum 1 — November 3, 2000

Accessing the General Curriculum: Promoting a Universal Design for Learning

The movement in most states toward standards-based and standards-driven curriculum education reform has resulted in an increased emphasis on learning outcomes for all students, including those with disabilities. A universally-designed curriculum uses technology to build in flexibility, permitting customized learning experiences for individuals with differing levels of ability and styles of learning. A traditional book is a limited technology that works well for a number of people, but is ineffective for many others. It cannot be used by those who are blind or by those who cannot move the pages. CAST's (Center for Applied Special Technology) work has focused on finding ways to use technology to overcome limitations faced by some learners with disabilities. The idea that students with disabilities, given the means, are able to interact with the curriculum, benefit from it, and achieve improved performance drives the work of the National Center for Access to the General Curriculum (NCAC), located at CAST in Peabody, Massachusetts. In this forum, David Rose, Co-Executive Director of CAST and Principal Investigator at NCAC and Chuck Hitchcock, Chief Education Technology Officer of CAST and Director of NCAC described how universal design, recent neuro-scientific research, and technology have been combined to create universally-designed curriculum products useable by all students.

Universal design is a concept initially developed by architects to address the needs of all by removing physical barriers to structures (e.g., automatic doors, ramps, elevators) and designing tools easily accessible to all. The Center for Universal Design describes it as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. The intent of universal design is to simplify life for everyone by making products, communications, and the built environment more usable by as many people as possible at little or no extra cost. Universal design benefits people of all ages and abilities." Just as ramps and automatic doors have made buildings more accessible to those who use wheelchairs, accommodations and modifications in instruction can make the general education curriculum more accessible to students with disabilities.

David Rose described Universal Design for Learning (UDL) as a way to utilize the insights of recent scientific research that looks at the strengths and weaknesses of individual learners across three functional networks within the brain: recognition, strategy, and affect. UDL uses innovative media technologies to build a curriculum that can respond to individual differences in teaching and learning, and provides adjustable ways of representing information, expressing ideas, and engaging students in their own style of learning. According to David Rose, technology in today's classroom will "make the work of teachers more nutritious for the mind."

> *...technology in today's classroom will "make the work of teachers more nutritious for the mind."*

"Technology is making large changes in education," says Rose, "especially in the way that we understand what learning really is." He discussed recent advances in the neuro-sciences field that are beginning to raise awareness of how the brain processes information. Using fMRI/PET scans (used for neuroimage mapping of brain activity), scientists are able to look at a colorful x-ray-like picture of the human brain and see it working. Changing patterns within the image of the brain reveal areas working in the brain and are known to researchers as "glucose burns." The brain uses glucose as an energy source. As mental strain increases, glucose is burned in greater quantity. By studying the changing patterns or glucose burns, researchers observed that during tasks such as reading, the brain acts in a highly modularized fashion to process information. According to Rose, there are specialized processors that do their own part to "operate like a well functioning ad-hoc committee." During different tasks such as reading words, listening to words, speaking words or generating words, the distribution of glucose burns is located on one or both hemispheres—in the front, middle or back of the brain. Researchers describe these patterns as signatures and have found that the signatures are highly distributed throughout the brain during various language tasks. There is a heavy burning of glucose while the brain is learning something new, like reading a new word or solving a mathematical equation. A number of trials later, on the same task, there is no longer the intense glucose burn. Re-doing the same task but with slight variation, such as adding new words or numbers burns some glucose, but not to the same extent as when the task was new.

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With this recent neuro-scientific research in mind, Rose invoked the work of a turn of the century developmental theorist, Lev Semenovich Vygotsky, whose ideas were explored by psychologists in the 1960's. Vygotsky's "zone of proximal development" describes the "distance between the child's actual development level ... and the child's level of potential development." Vygotsky's belief is that to facilitate learning and "bring student engagement to an optimal level of challenge," educators must develop lessons that bring the child to their "zone of proximal development" and give them the support they need to meet their potential. Using this supporting brain research and Vygotsky's theory, Rose explained that CAST's work has been focused on developing products that use technology to bring children with disabilities to their zone of proximal development quickly.

Rose examined the results of four different tasks during one study of the brain's reaction to reading a story: reading for the moral of the story, reading for grammar and syntax, observing the style of font, and reading and analyzing semantics. He diagramed the burning of glucose as it occurred in the brain as each task was undertaken. According to Rose, this study demonstrated that the brain uses the processors it has, as it needs them. The challenge for teachers is that they are faced with students who, at any given moment in class, may be processing the same piece of text or information in different ways. Students who are dyslexic may be wearing themselves down trying to decipher the words of a story leaving their brain with little energy (glucose to burn) to process the moral of the story. Rose adds that autistic students may be excellent decoders, but may miss the moral of a story. The findings from this brain research further substantiate the range of individual differences in how we learn.

In parallel processing, the brain uses many processors to recognize an image. The back part of the brain looks at the image it sees and tries to recognize it. The front part seeks a strategy for investigating the image carefully. The affective part of the nervous system looks for things that are important to survival, asking— Is it scary? How important is this? etc. "In education reform," says Rose, "we act as if kids need to take things out of context in order to make them more simple to understand, but this is not the way the brain operates. The brain operates in parallel, looking for content and context." Rose suggests that by instruction that isolates bits of information, some educators are compro-

mising their student's capacity to comprehend, making learning more difficult. Learning styles are subject to individual differences that must be considered. When we read, we use all of these processors, at various times, to decipher what we are reading. Different interventions are needed to address the reading styles of different individuals. It is very hard for educators to know what to do with traditional materials in the classroom, because these materials are usually mass-produced—one size fits all. "This is not a good design in an educational environment, because there is great variability here."

The technology found in CAST's software can read aloud individual words and entire passages of a book. This is particularly helpful for those who are dyslexic or for students with limited English proficiency. With support largely from private foundations, CAST developed the eReader™ software program, a strategic reading tool that supports higher level reading comprehension in students with learning disabilities, visual impairments, reading disabilities, or those who have trouble with language proficiency. The eReader™ software can take content from the Internet, word processing files, scanned-in text, or typed-in text and combine it with talking and reading software to enhance literacy development. The flexible features of eReader™ allow the user to: select volume, speed, and pitch of the reading voices; change the default font, style, color, and size of the text; control movement through the text; take notes and receive speech feedback while typing. CAST has developed guidelines for publishers of digital textbooks and created instructional techniques for the use of eReader™. CAST is currently working on software to help students who have weak strategies for comprehending what they read by building strategies directly into the text.

In partnership with Scholastic, CAST has developed Wiggleworks™, a literacy development program for young readers. It is a reading curriculum that provides a balance of challenge and support to beginning readers through a combination of speech, sounds, graphics, text, and customizable access features. The program can be adjusted to individual needs for recognizing information in different ways. "WiggleWorks™ is the first technology of its kind that says we can build universal design in a traditional classroom. It's not meant for special needs students alone, it's for all the children in the classroom. For those with special needs, the assistance is built in," says Rose. The

program builds learning assistance directly into the books stored in the software, providing a more supportive learning environment. A user may choose to have the program read aloud a word, sentence, or passage more slowly; change the size of the text as needed; or add a scanning device with a switch that allows users with limited mobility to move through the text and turn pages by, for example, moving the chin. "We can build a mentor right into the book. We can scaffold assistance into the lesson. We can build in evaluation of the program because the program has a microphone for users to test how they have done with their reading." Rose says that this is the beginning of a movement to get more kids into their zone of proximal development. Using technology to level the playing field, educators can reduce the struggle of students with disabilities.

Chuck Hitchock explained that the National Center is a cooperative agreement with the Office of Special Education Programs (OSEP), U.S. Department of Education, in partnership with the Harvard Children's Initiative/Harvard Law School, Boston College, the Council for Exceptional Children, and the Parent Advocacy Coalition for Educational Rights. NCAC synthesizes existing knowledge about access to the general curriculum, evaluates polices that affect access, and acts as a national leader to disseminate news on activities in this area. The National Center is run by CAST which also coordinates curriculum development for the partnership. CAST's mission is to expand opportunities for individuals with disabilities through the development of and innovative uses of technology. CAST is in the process of forming a National Consortium on Universal Design for Learning, by gathering a community of educators and other professionals dedicated to developing systemic practice models that better serve the educational needs of all students. The principles of Universal Design for Learning are central to the mission of CAST, NCAC, and the National Consortium.

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Summary of Forum 2 — December 8, 2000

Creating Accessible Technologies — Practical Ways to Enable Youth to Reach Their Potential and to Overcome Barriers Faced in Employment, Education and Daily Living

Gregg C. Vanderheiden, founder and director of Trace Research & Development Center at the University of Wisconsin-Madison, shared information on trends in telecommunication and information technologies, including their potential to increase the opportunities or decrease the barriers faced by youth with disabilities as they prepare for and enter the job market. Vanderheiden highlighted how careful attention to access considerations up front can positively impact the functional abilities and productivity of individuals with a wide range of disabilities. He discussed a number of key points related to the use of technology by youth with disabilities.

Universal Design – benefiting multiple populations

To ensure the creation of accessible technology, one must pay attention to who will use it, how many people will use it, how practical and affordable it is, and who will produce the product on a mass scale. Businesses want to produce and market profitable mainstream products. If businesses are not able to make a profit from a product, they will not produce it. It is, therefore, essential that we not only develop technologies that meet the needs of people with disabilities, but also develop solutions that are commercially practical, cost effective, and attractive to the mass market. Assistive technologies will also be needed and have their place. However, in general, assistive technologies cannot keep up with the rapid pace of technology. Wherever possible, access should be built into standard products.

Building access features within the design of a product can also benefit more than just people with disabilities.

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Building access features within the design of a product can also benefit more than just people with disabilities. For example, since 1993 it has been mandatory for television manufacturers in the United States to include closed captioned decoders in their products for people with disabilities. These are now very widely used by people who do not have disabilities, including those who visit sports bars and fitness centers. People learning English as a second language have also benefited from closed caption decoders.

Technology is changing – creating new challenges but also opportunities

Today, technology is more powerful and less expensive than ever. For example, an inexpensive Nintendo game player has more power than the Cray Super Computer did in 1985. Also, technology now has unprecedented flexibility and ability to adapt to the needs of different users. To help the audience understand the adaptability of technology, Vanderheiden presented several examples of the changes in technology over time.

(a) *Hardware used to be open, now it is closed.* Newer versions and information appliances are no longer being released that are easily opened and reprogrammed by the user. Older approaches therefore will not always work – new approaches will be needed. Computers and products could be opened and new cards and accessories could be inserted.

(b) *Interfaces used to be hard programmed, now they are soft programmed.* The buttons on a telephone used to manually depress a switch that completed an oscillator circuit and generated the tone heard when dialing. Now, depressing the button simply causes a signal to go to the microprocessor in the phone telling it that a certain button has been depressed. The software instructions in the microprocessor then determine what happens (for example, generating a tone). By changing only the software, the functions of the buttons and the behavior of the phone can be varied to meet different needs.

(c) *Information used to be physical, now it is electronic.* Newspapers, books, and libraries used to be comprised of only hard copy printed materials, thus making their accessibility difficult for people who are

blind, those with low vision, and those who cannot read or who have physical difficulties precluding them from holding a book or magazine. Information is now available electronically, making it easier to translate into speech and increasing its accessibility to a greater audience of people. This technology transfers to forms, tests and other material previously only obtained in a printed version.

(d) *Technology used to be standard, now it is multi-standard.* In the past there were only a few standard operating systems such as DOS, Windows, Mac OS, etc. Now an expanding number of products exist that have custom operating systems for which adaptations or extensions are not available. The pocket PCs that run Windows actually have different processors and, therefore, programs that run on one pocket PC in Windows may not run another pocket PC.

(e) *Information technology used to be stationary, now it is mobile.* People used to sit at a stationary workstation and use a full size screen and keyboard. Increasingly, people are using mobile technologies that may not have a keyboard and may have a very small screen or no screen at all. People are now free to take their office with them wherever they go.

(f) *We used to be disconnected, now we are interconnected.* Most information technologies used on a personal level were disconnected and operated as stand alone systems. Now, everything is being interconnected, opening up new problems and new potential. Wireless products produced by major manufacturers such as Texas Instruments or Motorola may use Bluetooth™ radio frequency connectivity technology to allow products to speak to each other. Each product has a small low-powered radio built into it and can interconnect with other products just by being brought within about a 30-foot range.

(g) *We now have alternate and multiple interfaces.* Since many new products are software based, adding additional behaviors can be done by slightly extending the instruction set. Once the instructions for accessibility have been developed, the cost of manufacturing is low. The only manufacturing cost is the need for slightly more memory, and those costs are dropping.

Advantages for persons with disabilities:

Vanderheiden used the telephone as an example of the advantages of new technology. Software added to the phone can incorporate many types of accessibility, including compatibility with a TTY machine for individuals who are deaf or hard of hearing; a phone that speaks the numbers of each button when touched; a phone that displays large print for individuals who are blind or who have vision impairments; a phone that responds to voice commands; or a phone or keyboard that ignores extra key touches, adapting to individuals whose disability causes tremors or jerky motions.

Disadvantages for persons with disabilities:

Vanderheiden also provided several cautions about technology. Because systems are no longer standard, some persons with disabilities could instantly lose access to adaptive software when their school or workplace purchases new hardware, or they may be able to use the technology at school, but not at home.

Unfamiliarity with new software can put anyone at a disadvantage. For example, "many of us forget to hit the send button when using a cell phone, or can't program a VCR," says Vanderheiden. People who may have been "power users" of a technology may find themselves unable to use it because a barrier has emerged in newer versions of the technology. In the 1990s, computers became easier to use by more people when the Windows operating system was introduced. The sweeping takeover of this new technology phased out the older DOS-operated computers that provided an easier environment for individuals who are blind. Potential barriers might arise when schools start using computers to test students and adaptations are not allowed or available.

Vanderheiden recommends that policymakers consider ways of working with information technology companies to develop technology with universal appeal that not only helps individuals with disabilities but all people. Whenever possible, the needs of people with disabilities should be addressed during the research and design process, rather than later when barriers become apparent. Many companies are already practicing this foresight and are embedding a variety of adaptive technologies

in their products in ways that can be beneficial to all users, without getting in the way of those who do not need them.

Recent achievements of the Trace Center include co-authoring the World Wide Web Consortium (W3C) Web Content Accessibility Guidelines and development of the EZ™ Access techniques to provide cross-disability access in electronic products of all types, such as cross-disability accessible cell phone reference designs. This technology is currently available in kiosk systems, including a new voting kiosk and an ATM prototype.

Summary of Forum 3 — January 26, 2001

Preparing Youth With Disabilities for an Increasingly Technical Work Place

Policymakers gathered on Capitol Hill to listen to panelists describe the changing nature of work demands within today's increasingly technical work place, the effect of these changes on youth with disabilities, and promising solutions and strategies. The panel was moderated by Richard Luecking, President of TransCen, Incorporated, Rockville, Maryland. TransCen is dedicated to the design, implementation, and research of career development systems that benefit people with disabilities. TransCen is also a partner in the National Center on Secondary Education and Transition for Youth with Disabilities, funded by the U.S. Department of Education, Office of Special Education and Rehabilitative Services.

"Technology for youth with disabilities can be a double-edged sword," says Luecking. It may present a challenge, but it has also become a facilitator in helping to level the playing field for youth as they transition into the workforce. The use of technology is also increasing employer expectations of workers. Luecking, a self-described, "unabashed optimist" on progress in this area, says that the single factor that determines the success of youth with disabilities in today's highly technical workforce is their experience with real work *before* graduation from high school—the earlier, the better. Internships through systems such as the Bridges Program are helping youth get their first experience with employers while still in an educational setting.

> *... the single factor that determines the success of youth with disabilities in today's highly technical workforce is their experience with real work before graduation from high school—the earlier, the better.*

The Bridges Program was developed in 1989 by the Marriott Foundation for People with Disabilities to provide employment services and training to youth. Bridges' staff work with eligible students during

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their last year of high school and beyond graduation. The program works in three stages to help youth achieve their employment goals: developing job-readiness skills, developing a long-term vocational plan to gain real work experience to obtain employment, and participating in an internship with partnering businesses. The internship provides students with experience for 12 consecutive weeks in a community employment setting. The employer pays for wages and benefits, but is under no obligation to continue employment when the internship ends.

From 1993 to 1997, TransCen conducted a study* on data collected during internship experiences in the Bridges Program to identify significant predictors of post-secondary employment success. The largest group of youth with disabilities to participate were those with learning disabilities—followed by mental retardation, emotional, hearing, mobility, visual, and other disabilities. African Americans represented the largest number of participants, followed by Hispanics, Whites, Asians and others. Male participants led by only a slight margin over females. The overall completion rate of internships was 86 percent and post-internship job offers from host companies were given 77 percent of the time.

The TransCen study followed student progress at six-, 18-, and 24-month intervals after the completion of the internship. Employment rates at six-months post-internship were at 68 percent and dropped to 60 percent at 24 months. The study found that youth who received post-internship job offers were five times more likely to be employed six months later; and those who had completed an internship without receiving a job offer from their host employer were still four times more likely to be employed. After 12 months, students who received post-internship job offers were three times more likely to be employed; students who completed the internship experience were twice as likely to be employed; and those with emotional disabilities were half as likely to be employed. Finally, the study checked in on youth at 18 months after their internship experience and found only two significant predictors of post-secondary employment success: (1) youth with emotional disabilities were only one-third as likely to be employed and (2) minorities were only half as likely to be employed.

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*Luecking, R. and Fabin, E. (2000) Paid Internships and Employment Success for Youth In Transition. Career Development for Exceptional Individuals, 23, 205-221.

Important conclusions were drawn from the TransCen study. First, successful high school work experience, by youth in all categories of disability, leads to higher adult employment rates. Second, work experience is important for all categories of disability and the work done by all categories of youth is viewed as valuable by employers. Finally, continued post-school support is necessary for some categories of youth in order to sustain employment success—"or youth tend to flounder." Luecking reemphasised that there is a need to start working with youth with disabilities in transition programs, such as Bridges, earlier in the high school experience.

Michael Losey, former President and CEO of the Society for Human Resource Management, provided information on recent work force trends in the United States. He stressed that the labor shortage is destined to continue and employers will need to look to the currently underutilized pool of employees with disabilities. The country's labor force growth will continue to drop through the year 2020. He says, "any employer who thinks they can wait out this trend is in trouble!" A projection for the year 2006 shows that there will be 151 million jobs to fill and 141 million people in the workforce. But it is more than a labor shortage. "There's a serious skills shortage." The computer industry leads the list of selected occupations for which anecdotal evidence suggests a shortage. Securities and financial services, a leader in skills shortages in the past, now lags far behind. According to findings from a survey conducted by the Information Technology Association of America (ITAA), there is a demand for 1.6 million IT jobs and 843,328 of them will go unfilled. One job in every 12 will go unfilled.

Nevertheless, employers are not looking to the pool of youth and individuals with disabilities who are, as Losey described, an overlooked resource.

Eighty-two percent of employers are not prepared to address worker shortages and many are pressuring legislators to increase the amount of H1B visas that allow skilled workers from other countries to fill highly skilled, technical jobs in the United States. Nevertheless, employers are not looking to the pool of youth and individuals with dis-

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abilities who are, as Losey described, an overlooked resource. Employers may turn to those on welfare to seek employees, but that pool is shrinking because of changes in welfare policy, a stronger economy and a higher minimum wage. Losey argues that individuals with disabilities make up a larger group than those on welfare. Most are unemployed, underemployed, want to work, and are qualified; however, many are limited to working with their heads, not their backs. He advocates that employers should seek to get involved with programs and schools that train youth with disabilities for high tech jobs. "Most employees with disabilities have the brainpower to get the job done. They just need better education."

Marian Vessels, Director of the Americans with Disabilities Act (ADA) Information Center of the Mid-Atlantic Region, discussed how technology and accommodations in the work place make hiring youth with disabilities painless for employers. She recounted a number of examples of ways qualified workers with disabilities can productively perform a variety of tasks and how in making such accommodations for these workers, employers often make the work place more productive for *all* workers. Vessels provided four examples of effective and relatively "low-tech" accommodations in the work place:

(a) When a large employer hired an individual who was blind to work in customer service, where employees used the telephone and computer to input data, accommodations had to be made to adapt to the way that information was used and handled by that individual. By reevaluating the current system of data input, to make accomodations, the employer was able to streamline the organization's data input process. As a result of the accommodations, the new worker was more effective and efficient than her nondisabled counterparts, convincing the employer to give *all* customer service representatives the same accommodation.

(b) A nursery was hiring people with developmental disabilities to plant specific plants in designated places according to a placement chart. These employees were unable to effectively identify plants by their formal Latin names, compromising the proper placement of plants. After job coaches analyzed the tasks involved, they found that by simplifying the task with color-coding, individuals with developmental disabilities were able to successfully perform the job. The rest of the staff began using the color-coded system and management found that

the color-coding resulted in a much higher rate of accuracy for *all* staff, including individuals with limited English proficiency.

(c) A service worker who was deaf was hired to do off-site work. There was a concern about how to get information to this individual effectively. It was determined that an off-the-shelf, vibrating, text pager would be an efficient and inexpensive form of communicating. The pager proved so effective that it was instituted as a means to schedule work and improve time management for *all* staff members.

(d) A support staff person with developmental disabilities had a difficult time staying on track and keeping to a time schedule. With the use of reminders from a PDA (Personal Digital Assistant), a device with a calendar and timer, the staff person was able to stay on schedule. It proved to be such an effective management tool that many of the other employees were provided one as well.

Student panelist Teresa LoProto, a senior at Rockville High School in Rockville, MD, described how a combination of technical training in computer software applications and an employment internship have positioned her to begin a career in a technology-related field. Deaf since birth, she requires the occasional services of an interpreter, but this accommodation has not put limits on her job performance or career aspirations. LoProto recounted a number of educational offerings in high school that have included computer technology training as an adjunct to her academic subjects during her junior year. Now in her senior year she works as a part-time, paid intern at a high-tech company that uses computer-assisted design and other technology to reproduce high-security signatures, among other products. She rated the mentoring she receives from her work supervisor as key to her successful performance. LoProto also credits her high school technology training classes for giving her direction in her career development and looks forward to pursuing a technology-related major in college.

Richard Luecking stressed that in conjunction with efforts to prepare youth with disabilities for an increasingly technical work place, it is imperative to also educate employers on the uses of technology as it relates to the increased productivity of this type of employee. As Mike Losey explained, hiring youth with disabilities "has to be a benefit employers feel they are getting before things will change." Employers

may be afraid to use technology because they think it is prohibitively expensive or time consuming to initiate. However, according to Vessels, the majority of accommodation costs rarely exceed $500 per employee—with half having no cost to the employer. More importantly, initiating thoughtful and creative technical solutions may not only help facilitate accommodations for workers with a disability, but may bring a new perspective and cost-effective solution that can positively affect all employees and bring added benefits to the employer. Telecommuting is one example of an attractive alternative for many individuals, particularly those with disabilities. Employees working from home, communicating via phone, email and transmitting computer files on-line, in many cases, is a cost effective alternative for business.

> *Hiring youth with disabilities "has to be a benefit employers feel they are getting before things will change."*

Richard Luecking announced that there is a national Business Leadership Network (BLN) that uses a business-to-business approach to promote this idea to other leaders. They are discussing how to prepare youth with disabilities for jobs and are beginning to go into schools. The BLN is a program of the Office of Disability and Employment Policy, Department of Labor.

Lastly, an assistive technology project is available in every state and U.S. territory to assist individuals with disabilities, their families, and service providers with information on access to and funding of assistive technology. Ten regional ADA information centers (Disability and Business Technical Assistance Centers, DBTACs) are located across the country to provide technical assistance information on reasonable job accommodations for individuals with disabilities, all aspects of state and federal law regarding reasonable accommodations, tax deductions, and tax credits. For further information, see the resources page in this publication for the ADA website.

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Conclusion and Lessons Learned

These forum presentations have described technological concepts and equipment, such as universal design for learning, equipment that responds to voice commands, and other adaptive technologies and programs that are growing in popularity because they offer sensible solutions that increase the standard of living for individuals with disabilities—in their daily lives, in school, and at work. Technology can increase the benefits youth with disabilities receive through public education, help develop high-level skills for the workforce, and smooth the transition through everyday life. Greater mainstream awareness of these assistive technologies can help create policies that promote their use within education, the workforce and society. By giving youth access to technology so they can learn and study more easily, we not only educate them, we help them to become more highly skilled, future employees and productive citizens.

Some lessons learned from the forum series include:

1. Teachers and administrators must recognize and respond to differences in the way students with and without disabilities learn. Technology can be used as a tool to help manage and respond to these differences.

2. Technology, both educational learning tools and everyday communication devices, should be designed with universal usability. Advances in software allow a range of solutions to be programmed into equipment to make it more accessible early on, rather than having to adapt at a later stage. The costs of adaptation are decreasing and this appeals to producers of such technology.

3. Transitions to work can be facilitated through high-quality and supported work experiences while a student is still in school.

4. Employers need to understand how technology and adaptations can aid workers with disabilities to be successful and that many of these adaptations improve nondisabled workforce productivity and efficiency as well.

5. Employers may expand their labor pool by using technology to create an accessible work environment.

6. Policymakers should support research and development efforts for technologies that increase the access that individuals with disabilities have to educational and employment opportunities.

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Informative Web Sites

Americans with Disabilities Act Information Center	www.adainfo.org
Americans with Disabilities Act Technical Assistance	www.adata.org
The Access Board	www.access-board.gov/
Assistivetech Network	www.assistivetech.net/
Assistive Technology Resource Manual	www.isbe.net/assistive/index.html
Bobby (a free service provided by CAST to help Web page authors identify and repair significant barriers to access by individuals with disabilities.)	www.cast.org
Business Leadership Network, ODEP, DOL	www.dol.gov/pcepd/projects/business.htm
Center for Rehabilitation Technology	www.arch.gatech.edu/crt/crthome.htm
Center for Universal Design	www.design.ncsu.edu/cud
Department of Health and Human Services Reports	http://aspe.hhs.gov/daltcp/reports.htm#employ
Electronic and Information Technology Accessibility Standards	www.access-board.gov/
Federal Communications Commission	www.fcc.gov/cib/cdtac/
High School/High Tech	www.high-school-high-tech.com/
Job Accommodation Network	www.jan.wvu.edu/english/homeus.htm
National Information Center for Handicapped Children and Youth	www.nichcy.org
National Transition Alliance	www.dssc.org/nta/
Office of Disability and Employment Policy, U.S. Dept. of Labor	www.dol.gov/pcepd/ztextver/about/about.htm
RESNA (Rehabilitation Engineering and Assistive Technology of North America)	www.resna.org
The Trace Center	www.trace.wisc.edu
TransCen, Inc	www.transcen.org
WC3 CSS Validation Service	http://jigsaw.w3.org/css-validator/
Web-Based Education Commission	www.webcommission.org/

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Examples of National Policy on Technology and Individuals with Disabilities

The Federal Communications Commission (FCC), SECTION 255 Telecommunications Access for People with Disabilities

The FCC has adopted rules to require telecommunications manufacturers and service providers to make their products and services accessible to people with disabilities, if readily achievable. The rules implement Section 255 of the Communications Act. Where it is not readily achievable to provide access, Section 255 requires manufacturers and providers to make their devices and services compatible with peripheral devices and specialized equipment that are commonly used by people with disabilities. For more information on these rules, visit the FCC's Consumer Facts page at www.fcc.gov/cib/cdtac/section_255_factsheet.html. For further information about Section 255 or other disability issues, visit www.fcc.gov/cib/dro, or write to: The Federal Communications Commission, Consumer Information Bureau, 445 12th Street, SW, Washington, DC 20554, or email fccinfo@fcc.gov or access@fcc.gov. Additionally, you can call the Commission's toll-free Consumer Information hotline, 1-888-225-5322 (voice), 1-888-835-5322 (TTY) *(Source: Federal Communications Commission, www.fcc.gov/cib/cdtac/section_255_factsheet.html)*

The Federal Information Technology Accessibility Initiative (FITAI) The Access Board and the General Services Administration (GSA) Electronic and Information Technology Accessibility Standards

The Access Board and the General Services Administration (GSA) are providing technical assistance to individuals and Federal agencies concerning the requirements of Section 508. The Federal Information Technology Accessibility Initiative (FITAI) is an interagency effort, coordinated by GSA. The Electronic and Information Technology Accessibility Standards provide criteria on what makes products accessible to people with disabilities, including those with vision, hearing, and mobility impairments. The Electronic and Information Technology Access Advisory Committee to the Board was composed of 27 members representing industry, various disability organizations, and other groups. The Access Board developed these standards under section 508 of the Rehabilitation Act as amended by Congress in 1998. The scope of section 508 and the Board's standards are limited to the Federal sector.

The new standards provide technical criteria for technologies such as software applications and operating systems; web-based information or applications; telecommunications functions; video or multi-media products; self contained, closed products such as information kiosks and transaction machines, and computers. Also covered is compatibility with adaptive equipment people with disabilities commonly use for information and communication access. The final standards, which will become part of the Federal procurement regulations, will help Federal agencies determine whether or not a technology product or system is accessible. *(Source: The Architectural and Transportation Barriers Compliance Board (Access Board), www.access-board.gov/news/508-final.htm)*

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